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Total 'rib'-preservation technique of internal mammary vessel exposure for free flap breast reconstruction: A 5-year prospective cohort study and instructional video

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HIGHLIGHTS

- We review the rib-preservation technique for internal mammary vessel exposure by a single surgeon.
- An instructional video is presented depicting how to perform the rib-preserving technique step by step.
- The 'rib'-preservation technique to dissect the internal mammary vessels is safe, reliable and reproducible.

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ABSTRACT

Introduction: The total 'rib'-preservation method of dissecting out the internal mammary vessels (IMV) during microvascular breast reconstruction aims to reduce free flap morbidity at the recipient site. We review our five-year experience with this technique.

Patients & methods: An analysis of a prospectively collected free flap data cohort was undertaken to determine the indications, operative details and reconstructive outcomes in all breast reconstruction patients undergoing IMV exposure using the total 'rib'-preservation method by a single surgeon.

Results: 178 consecutive breast free flaps (156 unilateral, 11 bilateral) were performed from 1st June 2008 to 31st May 2013 in 167 patients with a median age of 50 years (range 28–71). There were 154 DIEP flaps, 14 SIEA flaps, 7 muscle-sparing free TRAMs, 2 IGAP flaps and one free latissimus dorsi flap. 75% of the reconstructions (133/178) were immediate, 25% (45/178) were delayed. The mean inter-costal space distance was 20.9 mm (range 9–29). The mean time taken to expose and prepare the recipient IMV's was 54 min (range 17–131). The mean flap ischaemia time was 95 min (range 38–190). Free flap survival was 100%, although 2.2% (4 flaps) required a return to theatre for exploration and flap salvage. No patients complained of localised chest pain or tenderness at the recipient site and no chest wall contour deformity has been observed.

Discussion & conclusion: The total 'rib'-preservation technique of IMV exposure is a safe, reliable and versatile method for microvascular breast reconstruction and should be considered as a valid alternative to the 'rib'-sacrificing techniques.

1. Introduction

Autologous free flaps are considered by many to be the optimum technique for post-mastectomy breast reconstruction. Worldwide the internal mammary vessels (IMVs) have become popular as the first choice recipients for the microsurgical anastomoses [1–7]. Their popularity stems from the higher arterial pressure and large

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Venturi effect on venous drainage, comparable vessel size match, improved flap positioning and symmetry, the shorter vascular pedicle requirement compared to the thoracodorsal-subscapular system and allowing two surgeons to sit comfortably opposite each other during the microanastomoses. The IMV's have historically been prepared for microvascular anastomoses by performing the 'rib'-sacrificing technique [1–4] which removes a segment of the third costal cartilage in order to expose the underlying vessels. It provides excellent exposure in a wide space, between the inferior border of the second costal cartilage to the superior border of the fourth costal cartilage. However, several authors have highlighted a number of disadvantages with this approach, namely, increased post-operative local pain and long-term tenderness at the recipient site [8–10]. Furthermore, 5–14% of patients report chest wall contour abnormalities, characterised by visible depression on the medial chest wall [11–14]. In addition, with this more conventional approach the risk of pneumothorax, impaired vascularisation of the sternum and intercostal neuralgia may be increased [5,15–19].

The 'rib'-preservation technique was first described by Parrett et al. [9] in March 2008. It was adopted by the senior author in June 2008, refined [20], and has since been used exclusively for all breast free flaps. It reduces recipient site morbidity and has a number of well documented advantages including: shorter recovery time, decreased long term tenderness at the recipient site and a statistically significant ($p = 0.003$) reduction in postoperative morphine requirements [21], improvement in the overall patient experience and conservation of normal chest wall contour [14,21–23]. Its principal disadvantages are the learning curve (albeit short) and the significantly smaller available space in which to perform the anastomoses. This latter has the potential to lead to an increased ischaemia time and a shorter available vessel length for any revision of the microanastomoses. However, a study has demonstrated no statistically significant increase in ischaemia time with the 'rib'-preservation method compared to the 'rib'-sacrificing technique [20].

This prospective cohort study analyses the 5-year experience of a single surgeon (CMM) and includes an instructional video on how to perform the 'rib'-preservation technique of IMV exposure.

2. Patients & methods

2.1. Data collection

All patients who had undergone free flap breast reconstruction by a single surgeon (CMM), between 1st June 2008 to 31st May 2013 were identified from a prospectively collected free flap database at Addenbrooke's University Hospital (Cambridge). Their records were reviewed to determine the indications, operative details and reconstructive outcomes. Flap-related complications such as on-table anastomotic revisions, flap re-explorations, vessel thrombosis, flap loss (partial or total) and clinical fat necrosis were recorded.

2.2. Surgical technique (including instructional video)

Supplementary data related to this article can be found online at http://dx.doi.org/10.1016/j.amsu.2015.08.006.

Apart from the first four patients in the series the IMV's were prepared in the second intercostal space as it is consistently wider than the third and the IM vein is usually single and thus larger making for easier microsurgical anastomoses (Fig. 1) [3,4,20,25]. The pectoralis major muscle is split along the direction of its fibers using monopolar diathermy for a distance of 5 cm from the sternal edge. Two self-retaining Traver's retractors placed at 90° to one another are used to expose the second and third costal cartilages. The center of the anterior periosteum of the costal cartilage (CC) is incised for 3 cm from the sternal border with a size 10 blade and the incision is extended at either end 90° towards the 2nd space. The periosteum covering the inferior quarter of the 2nd CC and the superior quarter of the 3rd CC is then elevated using a periosteal elevator. It is not always necessary to elevate and excise the perichondrium although it does provide an additional 1–2 mm in the intercostal space. The two leaves of perichondria and the intervening intercostal muscles are then resected starting from the inferolateral corner while exerting gentle upward (vertical) traction on them and the dissection is advanced medially to expose the perivascular fat. Preparation of the vessels themselves then proceeds as in the 'rib'-sacrificing techniques, carefully avoiding damage to the underlying parietal pleura. The time taken to prepare the internal mammary vessels as measured from the start of the splitting of the pectoralis major muscle to dissecting out the IM artery and vein(s) ready for anastomoses was termed "digging time".

The statistical analysis of the data was carried out using Excel 2011 software (Microsoft Corporation). Categorical data were expressed as frequencies and percentages. Continuous data were expressed either as median and range or as mean and standard deviations. All tests were two-sided and the significance level was set as 0.05.

This observational cohort study is compliant with the STROBE checklist [26].

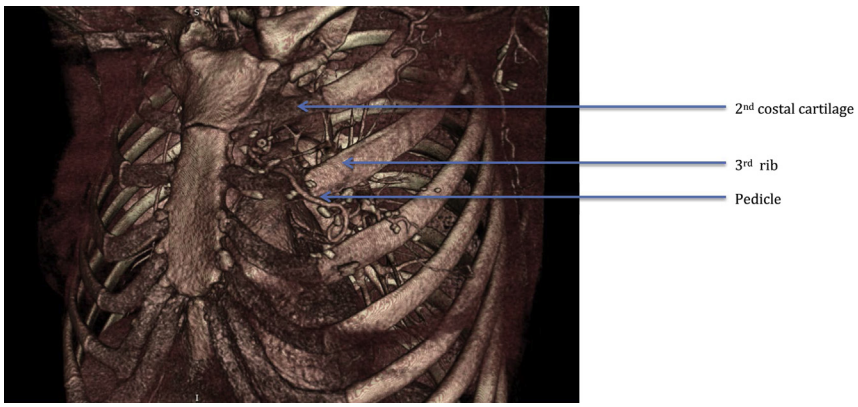

Fig. 1. Three dimensional CT scan showing the microvascular anastomoses and free flap pedicle at the 2nd intercostal space, between the 2nd and 3rd costal cartilages.